

# Bacterial Flora in Precataract Surgery Patients in a Northern Nigerian Hospital

Mahmud-Ajeigbe AF, Oladigbolu KK, Giwa FJ<sup>1</sup>, Abah ER, Rafindadi AL, Olayinka AT<sup>1</sup>, Pam VA

Departments of Ophthalmology and <sup>1</sup>Microbiology, Ahmadu Bello University Teaching Hospital, Shika-Zaria, Nigeria

## ABSTRACT

**Background:** Cataract surgery is the most commonly performed surgery in most ophthalmic units. Endophthalmitis is still a dreaded complication and knowledge of the normal bacterial flora on the ocular surface and adnexae is paramount in the management of these cases.

**Aims and Objectives:** To investigate the most frequently found ocular bacteria flora in patients scheduled for routine cataract surgery at the Ahmadu Bello University Teaching Hospital Shika Zaria, Northern Nigeria and to determine their antimicrobial susceptibility pattern.

**Materials and Methods:** This was a cross-sectional descriptive study carried out between December 2010 and February 2012 in subjects scheduled to undergo routine cataract surgery. The lower conjunctival fornix was swabbed with a sterile swab. The samples were inoculated onto enriched and selective culture media. Antimicrobial susceptibility testing was done using the modified Kirby Bauer standardized disc-diffusion method. Data were entered and analyzed using SPSS version 20.0.

**Results:** One hundred and fifty-seven eyes of 157 patients were sampled. The patients were between the ages of 16-96 years with a mean age of  $58.8 \pm 14.5$  years. Positive bacterial culture was found in 35% ( $n = 55$ ) of the patients. The predominant bacteria cultured was *Staphylococcus epidermidis* 49.1%. There was resistance to tetracycline (32.7%) and gentamycin (1.8%). All the isolates were sensitive to tobramycin and ciprofloxacin. A statistically significant relationship was found between age and culture status ( $P = 0.008$ ).

**Conclusion:** Coagulase negative *Staphylococcus* (*S. epidermidis*) was the most common commensal found in the conjunctival sacs of patients undergoing cataract surgery, and most of the isolates were susceptible to commonly used antibiotics.

**Key words:** Antibiotic sensitivity, cataract, conjunctival flora

## INTRODUCTION

It is estimated that about 48% of global blindness is due to cataract. In Nigeria cataract is said to account for 43% of blindness and 45.3% of severe visual impairment.<sup>[1]</sup> It is not surprising that cataract surgery

is the most common surgery performed in most eye units in Nigeria and around the globe.<sup>[2]</sup> Every type of surgery has its attendant complications, and one of the most devastating complications of cataract surgery is postoperative endophthalmitis. Although rare, this condition with an incidence of between 0.05% and 0.265%<sup>[3-5]</sup> can cause profound visual loss in as much as 80% of cases.<sup>[6]</sup>

**Address for correspondence:** Dr. Oladigbolu KK,  
Department of Ophthalmology, Ahmadu Bello University  
Teaching Hospital, Shika-Zaria, Nigeria.  
E-mail: oladigbolukehinde@yahoo.com

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Potential sources of causative organisms in cases of postoperative endophthalmitis include peri-ocular flora of patients, contaminated surgical intraocular instruments, and contaminated environment.<sup>[7-9]</sup> Bacteria in the conjunctival sac have been found to play a role in its pathogenesis.<sup>[10-14]</sup> Studies have reported the presence of bacterial colonies in the conjunctival sac of 55–100% of normal patients preoperatively.<sup>[15,16]</sup>

Conjunctival culture is not routinely done in patients undergoing cataract surgery in the study area. Preventive measures routinely carried out against postoperative endophthalmitis include the instillation of 5% povidone-iodine drops into the conjunctival fornix of all patients, ensuring strict maintenance of aseptic technique during surgery and the use of intra and postoperative antibiotics. Studies have demonstrated the effectiveness of 5% povidone-iodine aqueous solution for the eradication of pathogenic bacteria such as *Streptococcus pneumoniae*, *Staphylococcus aureus*, *Actinomyces pyogenes*, *Actinomyces meyeri* and *Actinomyces odontolyticus* in the conjunctival surface. There is also a significant reduction in the quantities of *Staphylococcus epidermidis* and *Micrococcus luteus* which are the commonly isolated bacteria flora in the conjunctiva.<sup>[17]</sup>

The normal conjunctival flora develops following birth and the pattern continues to change throughout life.<sup>[18,19]</sup> The pattern of conjunctival flora varies with the environment, age, sex, season, body resistance, and general hygienic conditions.<sup>[20]</sup> Rational use of prophylactic antibiotics is dependent on the knowledge of the resident conjunctival flora and its sensitivity pattern in that environment. This serves as an important tool in the management of patients undergoing cataract surgery or other intraocular surgery.

This study aims to investigate the most frequently found ocular bacteria flora in patients scheduled for routine cataract surgery at the Ahmadu Bello University Teaching Hospital Shika Zaria, Northern Nigeria and to determine their antimicrobial susceptibility pattern.

## MATERIALS AND METHODS

This was a cross-sectional descriptive study carried out between December 2010 and February 2012. The subjects were 16 years and above who were scheduled to undergo routine cataract surgery. Excluded were patients with any form of active ocular infection or inflammation, history or presence of blepharitis or conjunctivitis. Also excluded were patients who had previous use of topical eye drops or ointment and systemic antibiotics within the last 3 months. All patients gave full written informed consent, ethical clearance was obtained from the Hospital Ethical Committee and

the study was carried out according to the Helsinki declaration.

Only one eye of each of the subjects was sampled (i.e., the eye undergoing surgery). The lower conjunctival fornix was swabbed with a sterile swab. Employing a continuous stroke from the nasal to the temporal side, the swab was rolled to the other side and another stroke was done from the temporal to nasal side. One of the investigators took all the samples with the aid of sterile gloves, a face mask and a cap. No anesthetic or disinfecting agents were used on the eyes before sample collection. The samples were taken directly to the microbiology laboratory and inoculated within 15–30 min of collection.

The samples were directly inoculated onto enriched (Blood and Chocolate (Oxoid Ltd., England) and selective (MacConkey (Oxoid Ltd., England) culture media and were incubated in carbon dioxide enriched and aerobic atmospheres respectively at 35°C for 24–48 h. A smear was also made from the swab and a primary Gram-stain done. Cultures positive for bacterial growth were secondarily Gram-stained and further identified and characterized using colonial morphology, conventional biochemical tests, and analytical profile index (API® Staph. Kit [Biomérieux]). All bacterial isolates were tested for susceptibility to antimicrobials using the modified Kirby-Bauer standardized disc-diffusion method.

## Antibiotic susceptibility testing

The antibiotic susceptibility testing was carried out using the modified Kirby-Bauer disc-diffusion method as specified by the Clinical and Laboratory Standards Institute (CLSI, 2011). Antimicrobial agents used in testing were chloramphenicol 30 µg, gentamycin 10 µg, erythromycin 5 µg, tetracycline 30 µg, penicillin G 10 µg, tobramycin 10 µg, and ciprofloxacin 5 µg. All plates were incubated at 35°C for 18–24 h. The diameters of zones of inhibition were measured using a ruler to the nearest millimeter and compared and interpreted using the CLSI Interpretative chart (2011) as S (susceptible), I (intermediate) or R (resistant). *S. aureus* ATCC 25923 strain was used as quality control. Data was entered and analyzed using SPSS version 20.0 (SPSS Inc., Chicago, IL, USA). Where necessary, the Fisher's exact and Chi-square test were used to determine any significant difference with a  $P < 0.05$  considered statistically significant.

## RESULTS

We sampled 157 eyes of 157 patients. The patients were between the ages of 16–96 years with a mean age of  $58.8 \pm 14.5$  years [Table 1] and a male to female ratio of 2.3:1 [Table 2]. Positive bacterial culture was found in 35% ( $n = 55$ ) of the patients

[Tables 1 and 2], 65.4% ( $n = 36$ ) of these were patients above 60 years [Table 1]. All the bacteria cultured were Gram-positive. Majority (74.5%,  $n = 41$ ) of the organisms cultured were coagulase-negative *Staphylococcus* (CoNS) [Table 3].

The predominant bacteria isolated was *S. epidermidis* which made up 65.8% ( $n = 27$ ) of the CoNS and 49.1% ( $n = 27$ ) of the total organisms cultured. This was followed by *S. aureus*, *Staphylococcus hominis* and *Micrococcus* sp. each making up 9.1% ( $n = 5$ ) of the bacteria cultured [Table 3]. A statistically significant relationship was found between culture status and age ( $P = 0.008$ ), as well as sex ( $P = 0.01$ ).

Antimicrobial susceptibility testing was done using erythromycin 5 µg, penicillin g 10 µg, chloramphenicol 30 µg, tetracycline 30 µg, gentamycin 10 µg, ciprofloxacin 5 µg and tobramycin 10 µg discs. Out of the bacterial isolates cultured, 32.7% ( $n = 18$ ) showed resistance to tetracycline. Resistance each to erythromycin, chloramphenicol and penicillin was found in 11% ( $n = 6$ ) of the isolates and gentamycin resistance was found in 1.8% ( $n = 1$ ) of the isolates cultured. All the isolates were sensitive to tobramycin and ciprofloxacin [Figure 1]. There were no multidrug-resistant organisms.

**Table 1: Relationship of age and culture status**

Age group (years)	Culture $n$ (%)		Total $n$ (%)
	Negative	Positive	
10-25	2 (33.3)	4 (66.7)	6 (100.0)
26-40	10 (100.0)	0 (0.0)	10 (100.0)
41 and above	90 (63.8)	51 (36.2)	141 (100.0)
Total $n$ (%)	102 (65.0)	55 (35.0)	157 (100.0)

Fisher's exact:  $F=8.788, P=0.008$

**Table 2: Relationship of sex and culture status**

Sex	Culture $n$ (%)		Total $n$ (%)
	Negative	Positive	
Female	33 (21.0)	14 (8.9)	47 (29.9)
Male	69 (44.0)	41 (26.1)	110 (70.1)
Total $n$ (%)	102 (65.0)	55 (35.0)	157 (100.0)

Chi-square test:  $F=157.6, P=0.01$

**Table 3: Frequency distribution of bacterial isolates**

Organisms	Frequency	Percentage
<i>Kocuria varians</i>	4	7.3
<i>Micrococcus</i>	5	9.1
<i>Staphylococcus aureus</i>	5	9.1
<i>Staphylococcus capitis</i>	2	3.6
<i>Staphylococcus epidermidis</i>	27	49.1
<i>Staphylococcus hominis</i>	5	9.1
<i>Staphylococcus lugunensis</i>	2	3.6
<i>Staphylococcus saprophyticus</i>	3	5.5
<i>Staphylococcus</i> sp.	1	1.8
<i>Staphylococcus xylosus</i>	1	1.8
Total	55	100.0

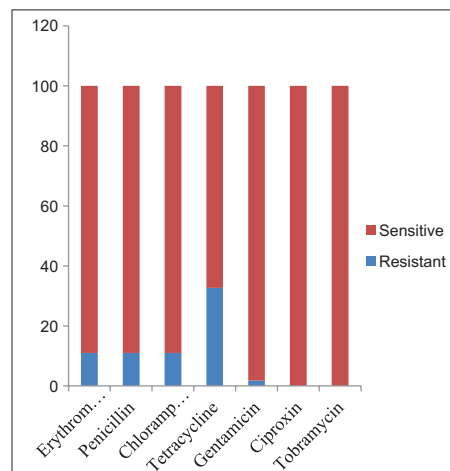
## DISCUSSION

In this study, 35% ( $n = 55$ ) of the subjects had a positive culture. Studies carried out here in Nigeria, and other parts of the world show a variation in positive cultures of preoperative conjunctival isolates ranging from 30% to 90%.<sup>[6,8,21-23]</sup>

CoNS made up 74.5% ( $n = 41$ ) of the isolates which was similar to de Kaspar *et al.*<sup>[21]</sup> and Mistlberger *et al.*<sup>[22]</sup> who had CoNS as 76% and 75% of their isolates in their study. This is probably because the studies were done at base hospitals following similar procedures to our study. The study in Ife, Nigeria<sup>[23]</sup> CoNS made up 50% of the isolates which is lower, while Chung *et al.*<sup>[24]</sup> in Korea had a higher value of 85%. Though in a study of the lid (closely related to the conjunctiva) Bekibebe *et al.*<sup>[13]</sup> found CoNS made up 70% of the bacterial isolates. This finding is most likely because the eyelids serve as filters for particles and debris attempting to enter the eyes, untrapped materials which eventually get into the conjunctival fornix will be similar to those filtered by the lids.

In the current study, 65.4% ( $n = 36$ ) of patients that had positive culture were above 60 years. This is similar to Suto *et al.* in Japan<sup>[6]</sup> who found that 79% of those with a positive culture were 60 years and over and also Omotoye in Ife<sup>[23]</sup> who found that 64% of patients with a positive culture were  $\geq 50$  years. The reduced personal hygiene of visually challenged elderly persons, as well as reduced immunity, could be responsible for this finding as immune function decreases with normal aging.<sup>[25]</sup> The high isolation rate in patients  $\geq 60$  years means they are more susceptible to post-operative infection and should, therefore, have more aggressive preoperative prophylaxis.

In our study, we did not culture any Gram-negative organisms while most similar studies done show low rates of isolation of Gram-negative. Suto *et al.*, de Kaspar *et al.* and Omotoye had 6.7%, 5.9%, and



**Figure 1: Antibiotic sensitivity pattern**

29.5%, respectively.<sup>[6,21,23]</sup> With regards to antibiotic sensitivity, we found that all the bacterial isolates were sensitive to ciprofloxacin and tobramycin. This was in contrast to studies from other parts of the world where there seems to be a growing resistance by organisms to the older fluoroquinolones. Suto *et al.*<sup>[6]</sup> found a 14% resistance to ciprofloxacin and de Kaspar *et al.*<sup>[21]</sup> found as much as 81% resistance to levofloxacin. Suto *et al.*<sup>[6]</sup> also found a 17.9% resistance to tobramycin whereas we found none. This can be explained by the relatively higher cost of these antibiotics in the study area making the likelihood of abuse less and by extension lower resistance by the organisms. Resistance to Gentamycin was found in 1.8% ( $n = 1$ ) of the organisms which compares with a study by Omotoye<sup>[23]</sup> who found 82.6% of their isolates sensitive to gentamycin, 11% ( $n = 6$ ) of organisms were resistant to erythromycin which is comparable to what Omotoye<sup>[23]</sup> found in 29% of their isolates. de Kaspar *et al.*<sup>[21]</sup> however found resistance in 50% of their isolates.

Chloramphenicol which is commonly used had an 11% ( $n = 6$ ) resistance from the isolates in contrast to Omotoye in Ife who found a 61.3% resistance to chloramphenicol.<sup>[23]</sup> Tetracycline had resistance from 32.7% ( $n = 18$ ) of isolates which is about half the proportion of Omotoye who found 71% of isolates resistant to this drug.<sup>[23]</sup> CoNS are the most prevalent bacteria in the conjunctival sac with *S. epidermidis* being the most common. Commonly used antibiotics such as chloramphenicol, gentamycin, ciprofloxacin, and tobramycin are still generally effective against these resident flora.

## CONCLUSION

CoNS are the most prevalent bacteria in the conjunctival sac with *S. epidermidis* being the most common. The high isolation rate in patients  $\geq 60$  years means they are more susceptible to postoperative infection and should, therefore, have more aggressive preoperative prophylaxis. Commonly used antibiotics such as chloramphenicol, gentamycin, ciprofloxacin, and Tobramycin are still generally effective against these resident flora.

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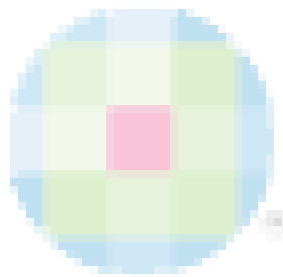
## Conflicts of interest

There are no conflicts of interest.

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